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Бишоп К.¹, Магомедов И.А.² Сердечная лимфатическая система

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Аннотация

Данная работа посвящена сердечной лимфатической системе. Рассматривается роль сердечной лимфатической системы, как защитного механизма от инородных тел и вредных бактерий. Также, в работе описываются структура сосуда, состав лимфы и дренажный путь. Наконец, дается объяснение субэндокардиального сплетения и субэпикардиального сплетения.

Ключевые слова: лимфатическая система сердца, капилляр, дренаж, структура сосудов

Abstract

The following work focuses on cardiac lymphatic system. Its importance as defense mechanism to a foreign bodies and harmful bacteria. Also, work outlines vessel structure, lymph composition and drainage pathway. Subendocardial plexus and subepicardial plexus are explained.

Keywords: cardiac lymphatic system, capillary, drainage, vessel structure, heart

Throughout the body, the complex network of fluid-filled vessels comprising the lymphatic circulation serve as a first-line defence against foreign bodies and harmful bacteria, whilst also maintaining fluid homeostasis in the tissues [1]. Lymphatic drainage of the heart specifically is minutely complex, yet sparsely documented in relation to that of other anatomical areas [1-3]. This is despite the system's clinical significance in the development and prognosis of many pathologies; for instance, Kline [4] has studied its role in the metastatic disease process and determined that it provides the route for tumour metastasis to the heart in the majority of cases of tumour spread. In a third of these cases, congestive heart

failure as a result of tumour metastasis to the heart was believed to be the primary cause of death. The cardiac lymphatics have also been found to play a fundamental role in the outcome of cardiac transplants, in part due to their involvement in physiological processes such as inflammation and tissue recovery [5]. It has also been argued that inadequacy of the heart lymphatics predisposes the coronary arteries to inflammation, fibrosis and ultimately atherosclerosis [6, 7]. Although these roles in pathology played by the cardiac lymphatics are widely acknowledged [1, 2, 4-8] research progress in this area has been slow in even recent years, largely due to the difficulty of lymphatic vessel imaging [8]. This report aimed to review the current literature describing the cardiac lymphatic system, and present detailed findings on its anatomy and development.

Vessel Structure and Lymph Composition: As elsewhere in the body, the system of lymphatics in the heart begins with the ‘initial lymphatics’, capillaries originating from the interstitial space and possessing a non-continuous endothelium and basement membrane – these features facilitate the passage of hydrophilic molecules, viruses and bacteria [9]. They do not contain any smooth muscle cells, however their endothelial cells have been observed to contain actin-like filaments [9,10]. The lymphatic networks overall are blind-ended and characterised by a pervading system of one-way valves, resembling the venous networks in this manner [10]. The cardiac lymph itself is comprised of the excess interstitial fluid of the heart. It contains numerous proteins in concentrations similar to those found in the blood plasma [11]. In addition, vascular components can be found in the cardiac lymph. One example is blood cells; specifically, white blood cells have been found to range from 800-5400/mm³, and red blood cells from 16-250x10³/mm³ [11, 12]. Other substances which have been observed in cardiac lymph include metabolites such as lactate and pyruvate, as well as enzymes and platelets [9-11].

General Drainage Pathway: In general terms, the lymphatic circulation tends to correspond anatomically with the vascular circulation [13], however there are some differences between the fluid pathways. The lymphatic capillaries differ from the blood capillaries in that their vessel walls are permeable to proteins and large molecules from the tissue spaces, whereas the blood capillaries can only absorb an aqueous solution of sugars and inorganic salts [13,14]. The lymphatics can therefore assist the capillaries, venules and veins of the blood vascular system in removing excess fluid from the tissues, and returning it to the bloodstream via lymphatic ducts [1,13]. Lymph, which is the name given to interstitial fluid once inside a lymphatic vessel, is absorbed from the tissue spaces, then passes through peripheral plexuses and into collecting vessels [14]. After being filtered through lymph nodes (small aggregations of lymphatic tissue), it is returned to the blood vascular system through the lymphatic ducts. [1,13,14]. Gray [14] and Loukas et al [15] effectively divide the drainage of the cardiac lymph firstly into three plexuses. These are subendocardial, myocardial and subepicardial, corresponding to the synonymous layers of the cardiac wall. The subepicardial plexus receives lymph from the subendocardial and myocardial plexuses; efferent vessels from the subendocardial plexus then become the main collecting trunks for the heart on the right and on the left. Following the right trunk first, which can be seen in Figure 1: lymph from the right atrium and part of the right ventricle (the diaphragmatic surface and right border) is received, before the trunk travels superiorly within the coronary sulcus, then progresses anteriorly to the ascending aorta, and ends in a brachiocephalic node, on the left-hand side.

Figure 1. Lymphatic Drainage of the Right Side of the Heart. Adapted from [1]. Anterior view. Dotted lines represent posterior structures. Arrows represent direction of lymph flow.

Following the left-sided pathway, within which there is usually less variation than the right: lymph is received from the right and left ventricles as the trunks ascend the interventricular sulcus on the anterior surface of the heart. They join with a larger vessel in the coronary sulcus, which has drained the lymph from the left ventricle's diaphragmatic surface and ascended within the posterior interventricular sulcus before travelling left in the coronary sulcus. This vessel and the left trunks form a new vessel, which carries the lymph superiorly between the left atrium and the pulmonary artery [14-16]. This vessel normally ends in a tracheobronchial node, as can be seen in Figure 2.

Figure 2. Lymphatic Drainage of the Left Side of the Heart. Adapted from [1]. Anterior view. Dotted lines represent posterior structures. Arrows represent direction of lymph flow.

It should be noted that although the patterns described above are the norm, study of lymph flow in canines has shown that variations in cardiac lymphatic anatomy are common [17,18].

Subendocardial Plexus: By 1972, the subendocardium had been demonstrated to possess an extensive network of lymphatic drainage with variously-angled branching; since then it has been estimated that one subendocardial lymphatic capillary drains ~1,300 blood capillaries [15]. Like other lymphatic capillary networks, this plexus is derived from the basal membrane and blood endothelium, and is itself observed as a significant dilation along these vessels. The flow of lymph travels outwards through the heart wall from the plexus and proceeds to flow into the myocardial plexus – but it seems at present that this outgoing flow

pattern does not hold clinical significance, and, since this is the view held in primary research as well as textbooks and reviews of the subject [1,12,15], it is a reliable assumption to make.

Subepicardial Plexus: The network of subepicardial lymphatics extends across the heart's outer surfaces, with capillaries ranging from around 15 to 20 microns in diameter, [3] and it is this superficial plexus that can interact with the pericardium to generate adhesions in various pathological conditions [20]. The collecting channels into which this loosely arranged plexus drains lie between the myocardial and epicardial muscle layers [1].

Conclusion. The cardiac lymphatics are a complex and understudied part of the human vasculature, performing the essential task of draining excess interstitial fluid from the heart – without them, the heart would be subject to quickly fatal levels of oedema in the tissues as well as severely compromised viral and bacterial immunity. The precise anatomy of cardiac lymphatic drainage involves flow through the subendocardial, myocardial and finally subepicardial plexuses before draining into right and left collecting trunks and ending in either brachiocephalic or tracheobronchial nodes. The network of draining vessels develop during embryonic growth from the established venous network; multiple studies have established LYVE-1 and VEGFR-3 receptor expression to be crucial to all stages of this process. Preliminary insights in the current literature into the control of lymphatic development show a potential area of focus for further research, with an aim to gaining a greater understanding of how to promote vessel proliferation. If this can be achieved, an opportunity to improve lymphatic efficiency in a clinical setting may arise, which itself has exciting implications for cardiac pathologies such as tumour metastasis, tissue rejection following transplant and atherosclerosis of the coronary arteries.

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Суставной синдром как внекишечное проявление болезни Крона: обзор литературы и клинический случай

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Аннотация

В последние годы заболеваемость детей воспалительными заболеваниями кишечника резко возросла. Одним из наиболее часто встречаемых воспалительных заболеваний кишечника является болезнь Крона. Помимо разнообразных кишечных симптомов, при болезни Крона встречаются и внекишечные проявления, например, артрит, или артропатия. При возникновении у ребенка суставного синдрома, в особенности при отсутствии серьезных изменений по данным рентгенографии, МРТ суставов, необходимо помнить о возможности развития у него воспалительного заболевания кишечника и провести все диагностические мероприятия.

Ключевые слова: воспалительные заболевания кишечника, болезнь Крона, артрит, внекишечные проявления, колоноскопия, кальпротектин

Abstract

Incidence of inflammatory bowel disease in children has significantly increased during the last years. One of the most wide-spread inflammatory bowel disease is Crohn disease. Apart from many intestinal symptoms of inflammatory bowel diseases, there may be some extraintestinal manifestations, such as arthritis or arthropathy. If a child has any problems with joints, even if there is no changes on X-ray images or MRIs, we should remember that his symptoms may accompany inflammatory bowel disease and do all necessary investigation.

Key words: inflammatory bowel disease, Crohn disease, arthritis, extraintestinal manifestations, colonoscopy, calprotectin

Частота возникновения воспалительных заболеваний кишечника среди детей и взрослых заметно возросла. Подсчитано, что у 15-25% пациентов первые симптомы заболевания возникают еще до наступления 20-летия. В частности, во многих исследованиях было продемонстрировано, что в последние десятилетия частота